Fermilab Independent QA Assessment Report

Assessment Number & Title: 11-IA-QA-014 WDRS Measurement & Test Equipment (M&TE) **Version:** 001

Date(s) of Assessment:
07/25/11 – 08/12/11

Performing Organization: Office of Quality & Best Practices

Assessed Organization(s): Workforce Development & Resources Section (WDRS) including the following:

- QuarkNet Program in the Education Office

Assessment Activities & Scope:

Implementation and effectiveness of controls for Measurement and Test Equipment (M&TE) relative to the requirements of Integrated Quality Assurance (IQA) were examined via interview, observation, and review of documents and records. These controls were examined across the WDRS organization listed in the "Assessed Organization(s)" section of this report.

Scope Limitations:

The QuarkNet Program in the Education Office is the only WDRS organization within the scope of this assessment because M&TE criteria are not applicable to other organizations or departments based on a QAR survey of WDRS managers and information obtained during the previous WDRS inspection & acceptance test assessment.

Activities Reviewed Within this Assessment:

- Inspect and test components for the QuarkNet Cosmic Ray Muon Detector Kit
- Assemble, inspect and test the QuarkNet Cosmic Ray Muon Detector Kit

Description of the Implementation & Effectiveness of Observed Activities:

<u>Measurement and Test Equipment:</u>
The M&TE requirements of IQA chapters five and eight are not met and therefore not effectively implemented within the WDRS Quarknet Program.

The QuarkNet Program team assembles Cosmic Ray Muon Detector Kits (CRMD) from purchased components in collaboration with PPD (File 01). File 02 contains a typical CRMD Kit components list. The QuarkNet team orders components from reputable, and where practical, from ISO 9001 certified providers (File 02) and inspects and tests these items prior to assembly (Files 03, 04 and 05). Completed CRMD kits are provided to national and international high schools and universities.

There is no evidence that instruments used as measuring and test equipment (M&TE) during inspection and test of Cosmic Ray Muon Detector (CRMD) components and assemblies are controlled in accordance with IQA requirements. There is no awareness of M&TE requirements for control such as: identification, calibration, or maintenance of instruments used for inspection, test, process monitoring, and data collection.

The assessment team observed the following six instruments used by the QuarkNet Program team to inspect and test product (see Appendix 1 for more details):

- Fluke multimeter model 179 serial 98340482
- Tektronix oscilloscope model TDS 224 serial C012425
- BK Precision pulse generator model 4030 serial 0302007
- Scherr-Tumico micrometer no model or serial numbers but 1232500 stamped on box
- Aerospace calipers no model or serial numbers
- Ohaus balance no model or serial numbers observed (owned by PPD in lab 6)

No calibration status or records of calibration exist for the six instruments examined and only one (Fluke multimeter) had a user's manual available. According to persons interviewed none of the instruments had been calibrated or checked against other instruments or standards to determine their accuracy or precision during at least four years of use.

Persons interviewed indicated that they were unaware of the requirements to control M&TE and have made no determination of the level of control required to assure that measurements are reliable.

Conclusions:
The WDRS QuarkNet Program team has not implemented the M&TE requirements found in IQA chapters five and eight. There is no awareness of M&TE requirements for control such as; identification, calibration, or maintenance needs for control of instruments used for inspection, test, process monitoring, and data collection.

Findings:

1. There is no evidence that instruments used as measuring and test equipment (M&TE) during inspection and test of Cosmic Ray Muon Detector (CRMD) components and assemblies are controlled in accordance with IQA requirements. IQA section 8.5 states: "The measuring and test equipment (M&TE) used for inspection and acceptance tests are identified, calibrated, maintained, and controlled commensurate with their intended use."

Observations and Recommendations:

1. **Observation:** There is no WDRS section-wide policy or procedure for controlling M&TE.
   Recommendation: The section should consider drafting a section-wide policy or procedure for controlling M&TE or an alternative such as organizational specific documents for affected WDRS organizations

2. **Observation:** The QuarkNet Program team was the only organization where potential M&TE was identified from a previous assessment and a recent email survey of WDRS managers by the QAR.
   Recommendation: The section should consider asking organizational or department managers to identify any instruments that are used to measure and test items to determine the extent of M&TE applicable requirements.

3. **Observation:** The QuarkNet Program team uses instruments they own and instruments owned by others (example Ohaus balance in lab 6 owned by PPD).
   Recommendation: The QuarkNet team should consider all instruments they use including ones that are

owned by others when determining the required M&TE controls.

Commendable Practices:

1. None observed

Names of Persons Interviewed:
Dave Hoppert

Documents Reviewed:

Train ITP Individual Training Summary (David Hoppert)
QuarkNet Cosmic Ray Muon Detector Kit
QuarkNet Suppliers Quality Assurance
QuarkNet Supplier Quality Assurance – Testing Notes
PDU Testing Procedures
PMT setup guidelines*
Preparing Epoxy for Gluing Cookies – January 2011
QuarkNet Quality Assurance (an fy2010 report identifying CRMD items returned by customers)

(See also "Attachments" section below)

* includes PDU, Oscilloscope, & Pulser set ups

Standards, Regulations, and Other Program Requirements Applied:

The specific criteria applied to this assessment were:
1001 IQA section 5.4.2, Maintenance (relative to M&TE)
1001 IQA section 5.4.4, Calibration of Process Equipment
1001 IQA section 8.5, Control of Measuring &Test Equipment

Describe or List Any Other Assessment Methods Used: None

Corrective Action Plans Issued: WD-20110801-01 There is no evidence that instruments used as measuring and test equipment (M&TE) during inspection and test of Cosmic Ray Muon Detector (CRMD) components and assemblies are controlled in accordance with IQA requirements. IQA section 8.5 states: "The measuring and test equipment (M&TE) used for inspection and acceptance tests are identified, calibrated, maintained, and controlled commensurate with their intended use."

Assessors' Names (asterisk indicates team leader):

- Jed Heyes* - OQBP
- Keith Schuh - PPD

Submitted by: : Jed Heyes **Date:** 08/12/11

Distribution (Distribute to assessed organizations' management, OQBP head, and other interested parties):

Marge Bardeen	Bob Grant
Dave Hoppert	Jed Heyes
Nicole Gee	Keith Schuh

Kay Van Vreede Ed Vokoun

Attachments:

File 01 - QuarkNet Cosmic Ray Muon Detector Kit
File 02 - QuarkNet Suppliers/ Quality Assurance
File 03 - QuarkNet Supplier Quality Assurance – Testing Notes
File 04 - PDU Testing Procedures
File 05 – PMT setup guidelines

Appendix 1 – QuarkNet M&TE Instruments Used

Device	Manufacturer	Model #	Serial #	Calibration Status	Used for
Multimeter	Fluke	179 This is a category III device	98340482	None Users Manual indicates "Accuracy specified for 1 year after calibration"	BNC (standard RF coaxial connector) & 50ft cables - continuity of PMT Voltage regulation subassembly & completed PDU voltage (In PMT setup guidelines it is called a voltmeter, in PDU testing procedure it is called a multimeter). Voltage readings 5.0-5.2v, 1.8v, 0.9v, 0.3v Only device with owner's manual available
Oscilloscope	Tektronix	TDS 224 4 channel digital	C012425	None	PMT setup & test Displays pulse sent to LED in lightproof box on Ch 3 Displays signal response from PMT on CH 1, (GO / NO GO test) Ch 1 set 2.00v/div, Ch 3 set 50.0mv/div (20.0mv if tubes less sensitive), Horizontal set 50.0ns/div
Pulse Generator	BK Precision 10MHz	4030	0302007	None "OK Test" Sticker with no date	PMT setup & test for a "Go / Provides 4v pulse (but not greater than 5v) of 50.0ns at 1.000Hz to LED in lightproof box to give light input to PMT under test (Sticker appears to be original manufacturer's)
Micrometer	Scherr-Tumico	None	None	None	Thickness – Scintillating plastic & Acrylic discs

					1232500 printed on the box is not from the manufacturer according to their representative
Caliper	Aerospace	None	None	None	Acrylic Disc "cookie" diameter & depth of notch
Balance	OHAUS	None observed 2610g capacity	None observed	None No calibration or check weights observed	Weight of epoxy components mixed to glue an acrylic "cookie" onto the scintillating plastic In lab 6 - owned by PPD not WDRS. Weights 5.0g resin 1.4g hardener

PMT = Photomultiplier tube PDU = Power distribution unit